REMARKS

Status of Claims

Claims 1-7 are pending in the application:

Claims 1 and 7 are amended for clarity following the helpful suggestions of the Examiner.

Support for amendment of claim 2 is found in paragraph [00011] of the specification as filed.

Claim 3, reciting the step of welding of two sheets, has been amended to independent form. Independent consideration of claim 3 is respectfully requested.

Claim Rejections - 35 USC § 112

Claims 1-7 as amended are rejected under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Applicants have carefully reviewed and revised the claims taking into consideration each point raised by the Examiner, taking care to introduce no new matter.

Withdrawal of the rejection is respectfully requested.

Claim Rejections - 35 USC § 103

Claims 1, 3-6 are rejected under 35 U.S.C. §103(a) as being obviouis over FUJIMOTO et al (JP 2002-178178 A cited by applicant) as evidenced by Dunsky et al (US 2001/0045419) in view of ISO et al (JP 2000-301374 A cited by applicant).

Applicants respectfully traverse.

Fujimoto et al do not use a scanner, and do not teach a decreasing spiral for forming a topographical change projecting from a surface of a sheet. The closest prior art discussed in the present specification, JP 11-047967 is similar to Fujimoto et al in employing a rigid lens system (see figures) and requires a relatively long time for re-positioning and machining, which, especially in mass production, translates to considerable costs.

Dunsky et al teaches a scanner, but teaches a very different process - forming holes or blind holes in a circuit board substrate having at least two layers with different absorption

characteristics in response to ultraviolet light. Dunsky et al do teach in Fig. 32 a widening spiraling profile 299a for reducing sidewall taper of the hole formed in the sheet. The discussion relating to Fig. 32 concerns ablation (removal) of a wider area in the center of the machining area and less area at the outer spiral section (paragraph [0122]). This has no relevance to the present invention.

Dunsky et al nowhere teach forming topographical changes projecting from a surface of a coated metal sheet in preparation for welding. If one were to apply the teaching of Dunsky et al to a coated metal sheet, one would not produce a spacer having the present shape. As explained in paragraph [0016] of the present specification as filed, "for a subsequent anti-corrosion treatment, especially galvanization, the shape of the topographical changes is crucial: According to the invention, an evenly contoured mountain is formed, according to JP 11-047967 a crater is formed. A mountain has a smaller surface than a crater formed from the same quantity of material, and thus a smaller area of attack from corrosion. In addition, a mountain can also be galvanized all the way round between two sheets, whereas a crater is covered by the above-lying sheet and cannot be galvanized on the inside. Moisture can get inside the crater as the sheets are joined together, and the topographical change becomes the corrosion seed." A widening spiral as taught by Dunsky et al would not produce the same shape as a decreasing spiral as presently claimed.

Those working in this art would not find within these references suggestion for combining these references, and employing a decreasing spiral technique to form topographical changes projecting from a surface of a sheet, on either the side facing the laser or the side opposite the laser, to make the present invention.

The present invention addresses and solves the problem of speed. With the present invention, a laser scanner is used for guiding the does not have to be positioned over the individual topographical changes, but can advantageously be guided on an optimized path between the topographical changes. These differences result in very different necessary machining times: using a laser scanner, it is possible to generate 30 suitable topographical changes in about 0.3 seconds; a conventional system requires about 10 times the machining time. This result is not obvious from the cited references.

Accordingly, withdrawal of the rejection is proper.

Turning to the position of the Examiner in greater detail, the Examiner considers Fujimoto et al teaches (re claim 1) a laser lap welding method in which a protrusion 2a is formed, by melting, on the side of the sheet 2 facing away from laser 1.

While the Examiner is correct, this is no closer to the present invention than the prior art already discussed and distinguished in the background section of the present specification as being slow and costly.

The Examiner considers it to be inherent in Fujimoto et al that the laser describes about the center of its machining area a narrowing spiral. (an inherent characteristic as shown by Dunsky et al (US 2001/0045419) See Figs. 21, 22, 32. which all show a narrowing spiral weld pattern.)

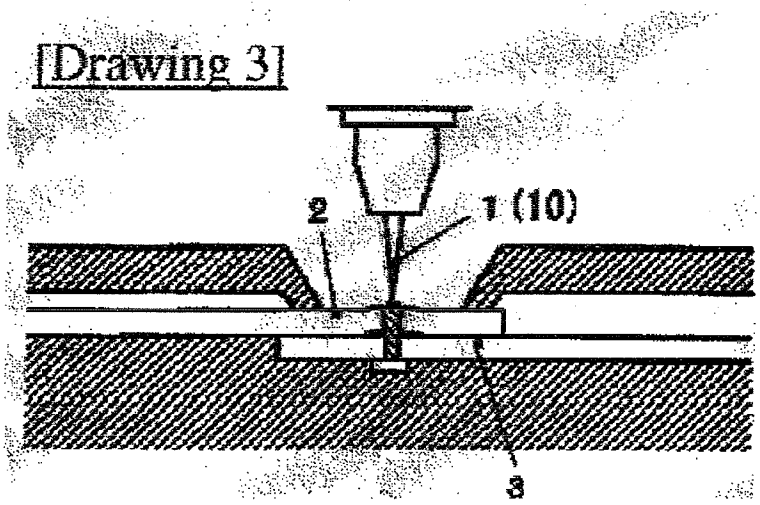
In response, Applicants point out that Dunsky et al relates to laser micromachining and, in particular, to a method and apparatus employing a single pass actuation (SPA) assembly to vary the power density of ultraviolet laser output applied to a target surface during processing of multilayer workpieces having at least two layers with different absorption characteristics in response to ultraviolet light. Dunsky et al form "vias" (holes) or "blind vias" in electronic materials.

Those of ordinary skill would not be able to take the Dunsky discussion relating to Fig. 32 concerns ablation (removal) of a wider area in the center of the machining area and less area at the outer spiral section (paragraph [0122]) to form a tapering hole, and translate this into forming a topographic projection on one side or the other of a sheet. Thus, the teaching of Dunsky et al does not relate to the present invention and the references can not be combined in the manner proposed by the Examiner.

Next, regarding Claim 5, the Examiner takes the position that Fujimoto et at teaches a protrusion on the side facing the laser and the side facing away from the laser as shown in drawing 3.

In response, Applicants point out that only Fig. 1 shows formation of a protrusion from one of the sheets, namely on the side opposite to the laser. Figure three shows two sheets being welded together. Fig. 3 does not provide suggestion as to how to solve the problem of venting vapors from between sheets yet ensuring optimal spacing between the two sheets and in particular does not teach the essential contact detecting techniques by which the present invention solves he problem.

[Drawing 3]



Next, the Examiner concedes that Fujimoto et al fails to show the use of a scanner for directing the laser beam. However, the Examiner considers that it is well known in the art to use a scanner for directing laser beam, as evidence, Iso et at teaches (re claim 1) a scanner for directing the laser beam wherein "a laser beam is introduced into the 1st galvanoscanner 14, and while branching introduces the laser beam of another side into the 2nd galvanoscanner 16 by the mirror 15. The structure of galvanoscanner is provided with the 2nd galvanomirror for making the laser beam from the 1st galvanomirror and this 1st galvanomirror for making a laser beam shake at an X axial direction shake at Y shaft orientations. Thus, the laser beam which came out of the 1st and 2nd galvanoscanner is irradiated on the work 20 through the ftheta lenses 17 and 18, respectively." (See Paragraph [0013]) It would have been obvious to utilize in FUJIMOTO et al, the scanner taught by Iso et al in order to direct the laser beam and provide a greater working speed (see paragraph 5, 9 and 31 of Iso et al) as well as good precision.

In response, Applicants point out that there is no teaching in Iso et al that guiding the laser beam to describe a narrowing spiral can generate at least one topographical change projecting from a surface that can be suited for a "spacer" for providing sufficient spacing between two sheets that vaporized coatings can vent.

Fujimoto et al. do not suggest a technique for forming a topographical change projecting from the surface comprising guiding a laser beam to describe a narrowing spiral about the center of its machining area, and Iso et al teaching of a mirror to make positioning of the laser beam faster does not remedy the deficiency of Fujimoto et al. as to forming a

projecting topographical change by guiding the laser beam to describe about the center of its machining area a narrowing spiral.

Next, claim 7 is rejected under 35 U.S.C. §103(a) as being obvious over Fujimoto as evidence by Dunsky et al (US 2001/0045419) in view of Leong et al (US Patent No. 6,329,635).

Fujimoto et al as evidence by Dunsky et al discloses substantially all features of the claimed invention as set forth above except for the-melting through is controlled by pre-specifying a processing time or by providing a penetration sensor which regulates the laser machining time.

Leong et al teaches a method for weld and laser heat treatment monitoring which involves determining depth penetration wherein the machining time can be controlled in term of a calibration curve.

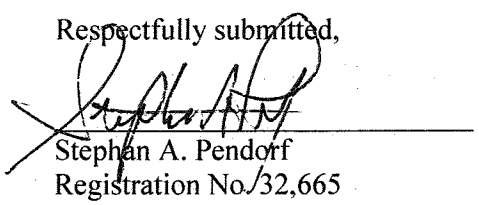
According to the Examiner, it would have been obvious to one having ordinary skill in the art at the time the invention was made to utilize in Fujimoto et al as evidenced by Dunsky et al, the calibration curve to pre-specify the processing time as taught by Leong et al in order to control the melting through the object or sheet depend upon the laser power level, speed, geometry, or design specifications if so desired.

In response, Applicants point out that present claim 7 is not directed to melting through a sheet, but rather to measuring penetration as data that can be translated into extent of formation of a topographical change on the surface of a sheet.

Accordingly, withdrawal of the rejection and early issuance of the Notice of Allowance is respectfully requested. Should further issues remain, the Examiner is respectfully requested to contact the undersigned at the indicated telephone number.

The Commissioner is hereby authorized to charge any fees which may be required at any time during the prosecution of this application without specific authorization, or credit any overpayment, to Deposit Account Number 16-0877.

Respectfully submitted,



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